Anticipated Benefits of the TOXECON Retrofit for Mercury and Multi-Pollutant Control Technology

Clean Coal Power Initiative

Full Scale Demonstration of TOXECON Mercury and Multi-Pollutant Control Technology

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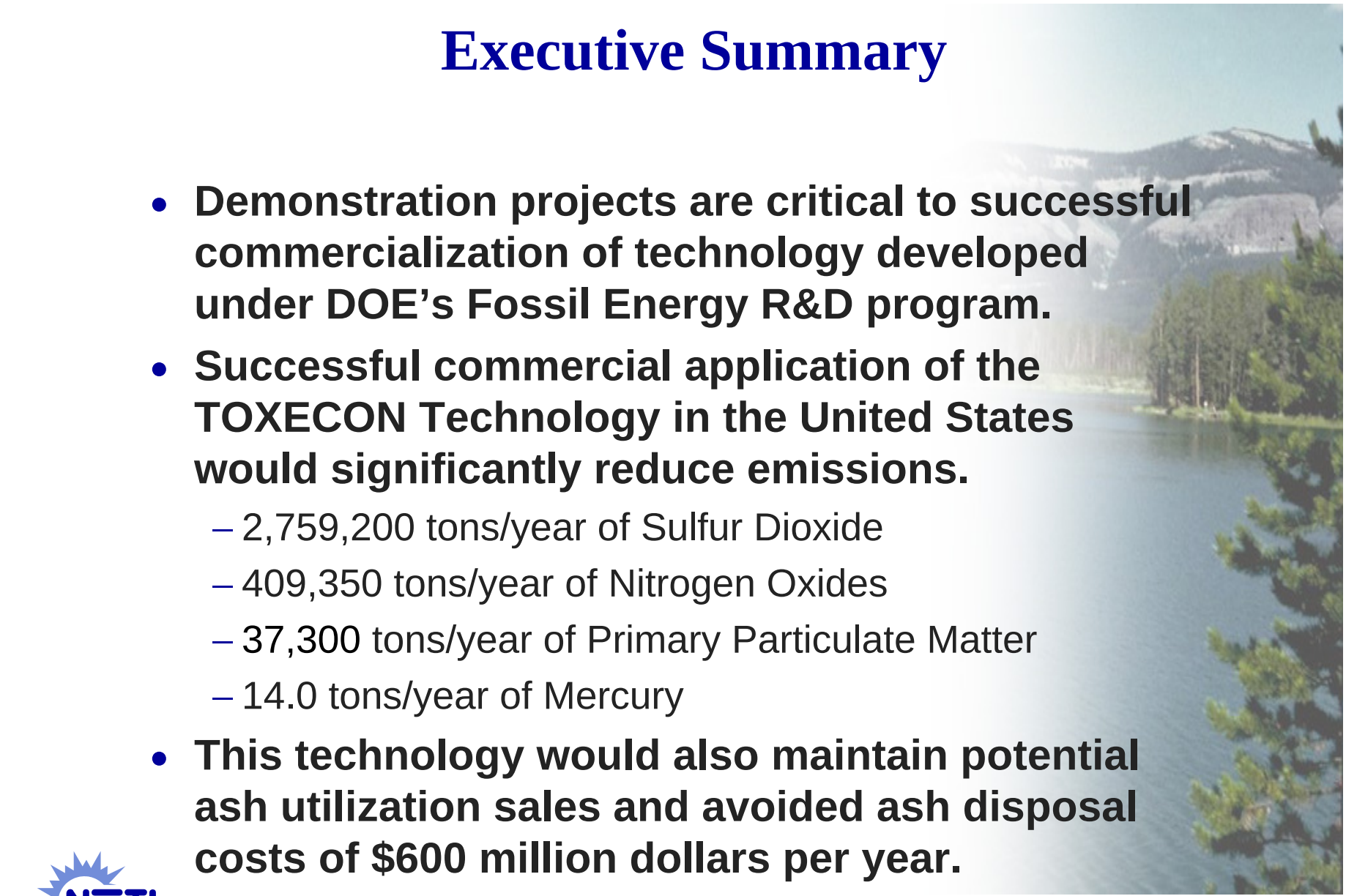
Executive Summary



- **Demonstration projects are critical to successful commercialization of technology developed under DOE's Fossil Energy R&D program.**
- **Successful commercial application of the TOXECON Technology in the United States would significantly reduce emissions.**
  - 2,759,200 tons/year of Sulfur Dioxide
  - 409,350 tons/year of Nitrogen Oxides
  - 37,300 tons/year of Primary Particulate Matter
  - 14.0 tons/year of Mercury
- **This technology would also maintain potential ash utilization sales and avoided ash disposal costs of $600 million dollars per year.**

Outline

- **Description of the TOXECON Mercury and Multi-Pollutant Control Technology.**
- **Quantitative estimates of the benefits of the TOXECON project.**
  - Benefits to the Nation
  - Benefits to Wisconsin Electric Power Company's Presque Isle Power Plant
- **Approach used to calculate benefits.**

TOXECON Project

- A 270 MW_e demonstration of the TOXECON Mercury and Multi-Pollutant Control Technology.
- Installed on the combined flue gas stream of units 7, 8, and 9 produced by low-sulfur, Powder River Basin, subbituminous coal at Wisconsin Electric Power Company's Presque Isle Power Plant located in Marquette, Michigan.
- Total project funding: $49,536,600

  DOE share: $24,768,300 (50%)

Presque Isle Power Plant

Major TOXECON Project Partners

- **ADA Environmental Solutions LLC**
  Process operation and Mercury CEM development

- **Cummins & Bernard**
  Engineering design/construction

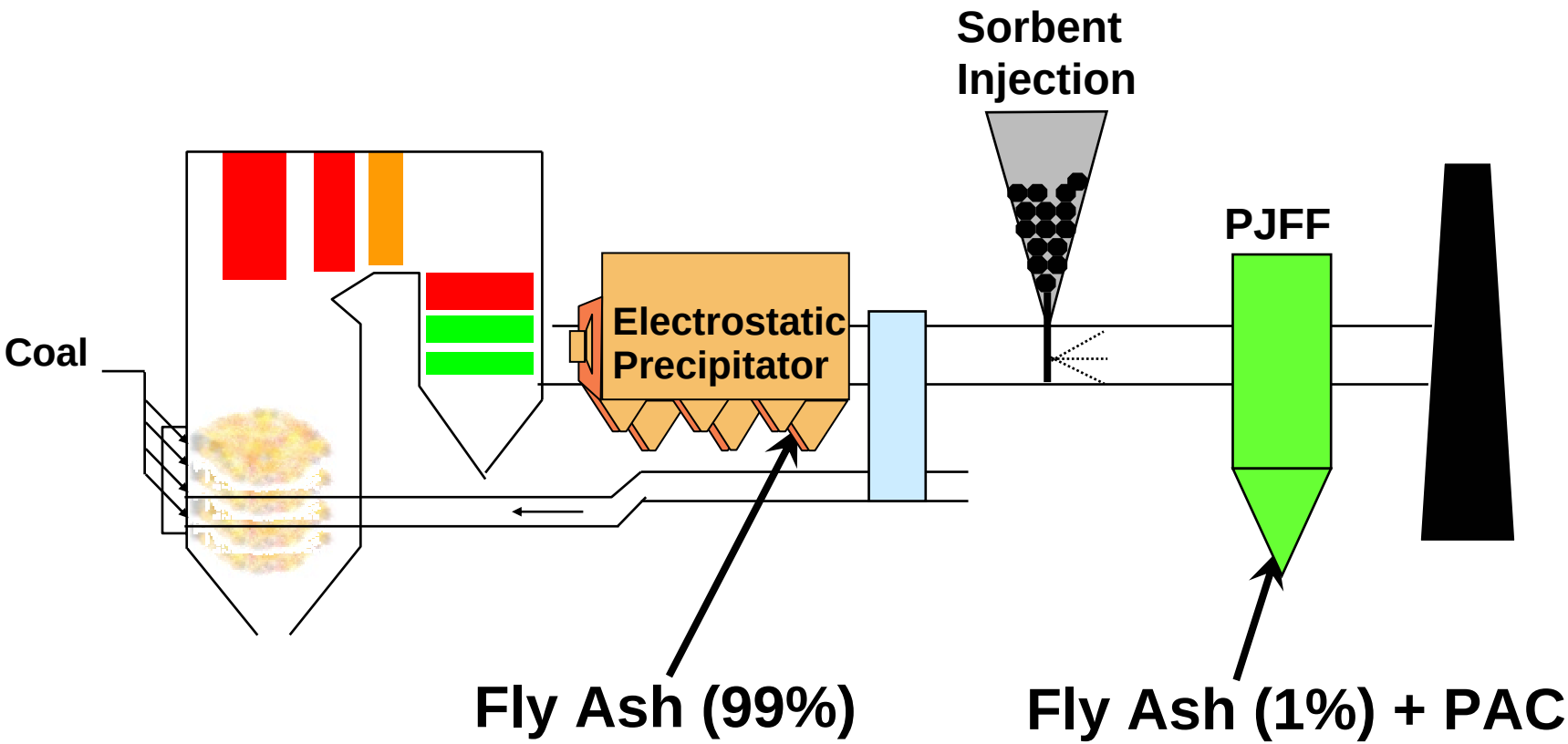
- **EPRI**
  TOXECON patent – process developer

- **Wisconsin Electric Power Company**
  Demonstration host site

TOXECON Mercury and Multi-Pollutant Control Technology

- Hot or Cold side ESP first removes 99% of the particulate matter. Fly ash remains salable.
- Powdered activated carbon sorbent is injected into the flue gas stream resulting in mercury emissions reductions approaching 90%.
- Additional sodium or lime-based products are injected to reduce NO_x, SO_2, and HCl emissions.
- A high air-to-cloth ratio baghouse will remove the remaining fly ash and sorbent products.
- The project also involves development of a Continuous Mercury Emissions Monitor.

TOXECON Process Configuration

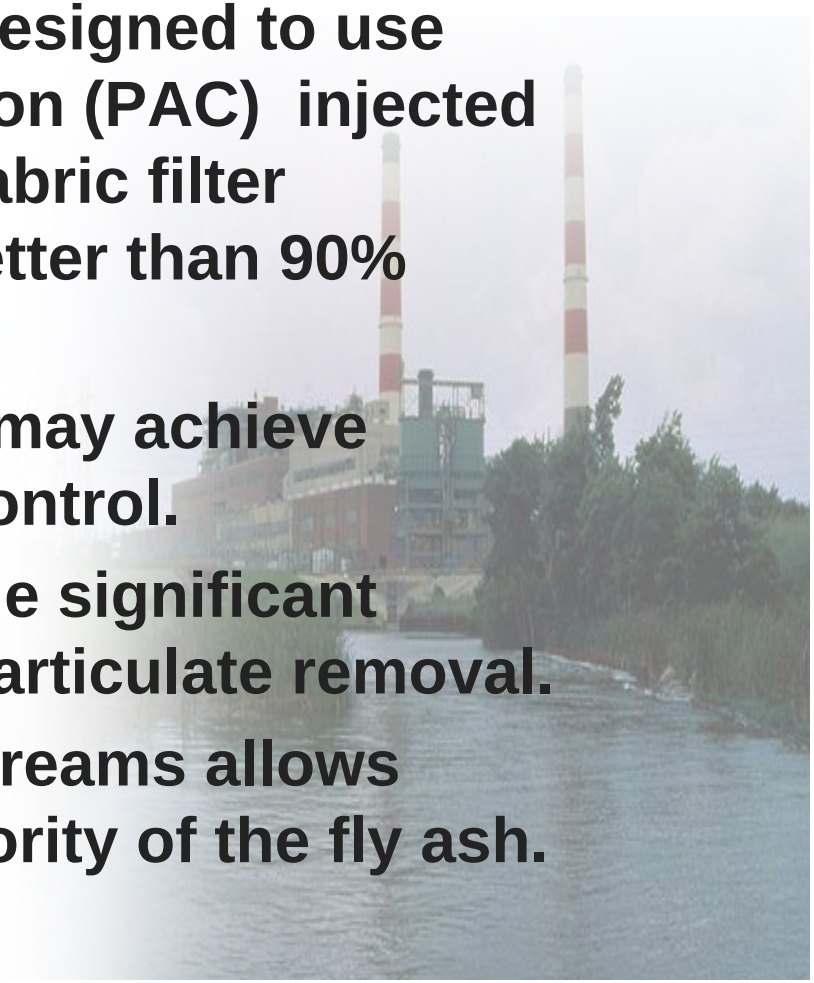


Advantages of the TOXECON Technology

- High Air-to-Cloth ratio baghouse leads to lower capital investment costs.
- Powdered activated carbon provides high level of mercury control.
- Baghouse contributes to high primary $PM_{2.5}$ and PM_{10} removal rates.
- Sodium sorbents improve SO_2 and NO_x removal rates.
- Separate collection of fly ash and mercury sorbent allows continued use of coal combustion by-products.

Unique Contribution of the TOXECON Process

- This new technology is designed to use powdered activated carbon (PAC) injected upstream of a pulse-jet fabric filter (baghouse) to achieve better than 90% mercury removal.
- Sodium based additives may achieve moderate NO_x and SO_2 control.
- The baghouse will provide significant primary $PM_{2.5}$ and PM_{10} particulate removal.
- Separate fly ash waste streams allows beneficial use of the majority of the fly ash.



Competing Technology Options

- Wet scrubbers.
- Other activated carbon injection approaches.
- Catalyst to convert elemental Hg to oxidized Hg followed by WFGD.
- Multi-pollutant control for Hg, SO_2, and NO_x by integrating established technologies.
- Semi-dry Circulating Fluidized Absorber (CFA)

Estimated Reductions in National Pollution Emissions from Commercialization

	Emission Reduction[1], tons/year	Current Emissions from all Coal-fired Boilers in the United States[2], tons/year
NO_x	409,350	4,611,940
SO_2	2,759,200	10,773,220
Particulate Matter	37,300	522,360
Mercury	14.0	48.6

[1] Basis: 97 GWe market penetration.
[2] Source: NETL Coal Power Data Base.

Additional National Benefits from Commercialization

- **Maintains potential ash utilization sales of $50 million dollars per year.**
- **Maintains avoided costs for waste disposal of $550 million dollars per year.**
- **Results in capture of fine primary particulate matter.**
  - 5,970 tons/year of $PM_{2.5}$
  - 13,330 tons/year of PM_{10}

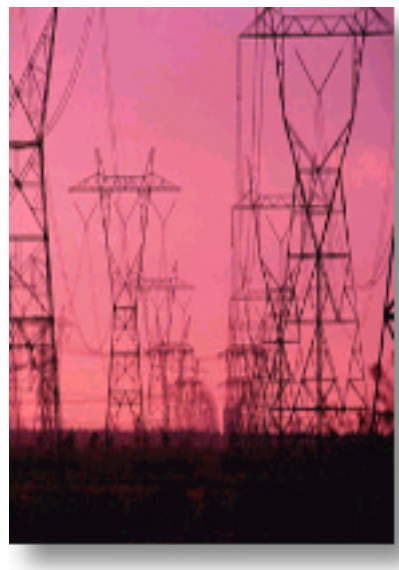
Benefits of TOXECON Technology for the Presque Isle Power Plant

Pollutant	Annual Emission Reduction
NO_x	1,470 tons
SO_2	4,020 tons
Particulate Matter	32 tons
Mercury	80 pounds

Multi-pollutant strategy reduces the release of pollutants at the Presque Isle Power Plant to very low levels.

Approach to Estimating Benefits

- **Forecast market penetration.**
- **Quantify differences between performance of conventional power plant with and without the TOXECON technology being demonstrated.**
  - Pollutant emissions, tons per year
  - Capital and operating costs



Assumed Market Penetration

- Individual boilers larger than 50 MW_e and without FGD scrubbing facilities were selected and confirmed utilizing the 2002 NETL Data Base.
- Units with current baghouse particulate control were considered as a portion of the market.
- Assumed that mercury control will be required regardless of boiler age.
- Assumed that TOXECON technology would not apply to units with wet scrubbers.

Assumed Commercial Market for TOXECON Technology

- There are 749 units generating 223 GW_e in the existing market.
- There are projected to be 108 new coal-fired units generating 54 GW_e by 2025.
- There are 52 units generating 17 GW_e in the Canadian market.
- National benefit estimates are based on capturing 97 GW_e of the North American market.

Differences in Emissions

- **Estimate based on achieving projected removal rates at specified target units.**
  - Achieve 90% Mercury removal
  - Achieve 70% SO_2 removal
  - Achieve 30% NO_x removal trim control
  - Achieve $PM_{2.5}$ and PM_{10} removal improvements
- **Allows continuation of fly ash sales.**

Differences in Emissions (Continued)

- Actual emission data provided by the 2002 NETL Database.
- NO_x, SO_2, Hg, and PM removal quantities are projected for the 97 GW_e market.
- Current flyash utilization and waste disposal quantities are used to project savings that result from the ability to maintain current levels of byproduct utilization.

Conclusions

- **There are significant benefits to the nation that will be realized by the commercialization of technologies being demonstrated in the Power Plant Improvement and Clean Coal Power Initiatives.**

Visit the NETL web site for information on all Power Plant Improvement Initiative and Clean Coal Power Initiative projects.

www.netl.doe.gov/coalpower/ccpi